Q.P. Code: 16ME320 **R16**

Reg. No: | | | | | | | | | | |

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

B.Tech III Year II Semester Regular & Supplementary Examinations October-2020

HEAT TRANSFER

(Mechanical Engineering)

Time: 3 hours Max. Marks: 60

(Answer all Five Units **5 x 12 = 60** Marks)

UNIT-I

1 **a** Name and explain the mechanism of heat transfer. **6M**

b Calculate the rate of heat transfer per unit area through a copper plate 45 mm thick, whose one face is maintained at 350 ^{o}C and the other face at 50 ^{o}C. Take thermal conductivity of copper as 370 W/m ^{o}C. **6M**

OR

2 **a** What is convection heat transfer? **3M**

b Derive the general heat conduction equation in Cartesian coordinate. **9M**

UNIT-II

3 **a** Derive an expression for heat conduction through a plane wall. **6M**

b A reactor's wall, 320 mm thick, is made up of an inner layer of fire brick (k = 0.84W/m ^{0}C) covered with a layer of insulation (k = 0.16 W/m ^{0}C). The reactor operates at a temperature of 1325 ^{0}C and the ambient temperature is 25 ^{0}C. Determine the thickness of fire brick and insulation which gives minimum heat loss. **6M**

OR

4 **a** Sketch various types of fins. Give examples of use of fins in various engineering applications. **6M**

b Calculate the amount of energy required to solder together two very long pieces of bare copper wire 1.5 mm diameter with solder that melts at 190 ^{0}C. The wires are positioned vertically in air at 20 ^{0}C. Assume that the heat transfer coefficient on the wire surface is 20 W/m^{2} ^{0}C and thermal conductivity of wire alloy is 330 W/m ^{0}C. **6M**

UNIT-III

5 **a** What is convective heat transfer? Distinguish between free and forced convection. **6M**

b Derive the expression for Reynolds number and how flows are determined by Reynolds number? **6M**

OR

6 **a** Mention correlation for flow over a horizontal plate. **5M**

b A horizontal plate measuring 1.5 m x 1.1 m and at 215 ^{0}C, taking upward is placed in still air at 25 ^{0}C. Calculate the heat loss by natural convection. The convective film coefficient for free convection is given by the following empirical relation $h = 3.05(T_f)^{1/4}$ W/m^{2} ^{0}C. where T_f is the mean film temperature in degree Kelvin. **7M**

UNIT-IV

7	**a**	What are the applications of boiling?	**2M**
	b	Explain briefly the various regimes of saturated pool boiling with diagram	**10M**

OR

8	**a**	Derive the expression for Logarithmic Mean Temperature Difference (LMTD) in case of counter flow.	**6M**
	b	The flow rate of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperatures on the hot and cold sides are 75 ^{0}C and 20 ^{0}C respectively. The exit temperature of hot water is 45 ^{0}C. If the individual heat transfer coefficients on the both sides are 650 W/m^2 ^{0}C, calculate the area of heat exchanger.	**6M**

UNIT-V

9	**a**	What is Stefan Boltzmann Law? Explain the concept of total emissive power of a Black Body.	**6M**
	b	Write short note on radiation shields.	**6M**

OR

10	**a**	State the following law: Krichhoff's law ii) Planck's law	**4M**
	b	Calculate the net radiant exchange per m^2 area for two large parallel plates at temperature at 427 ^{o}C and 27 ^{o}C respectively. ε (hot plate)=0.9 and ε (cold plate)=0.6. If a polished aluminium shield is placed between them, find the percentage reduction in the heat transfer, ε(shield)=0.4.	**8M**

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